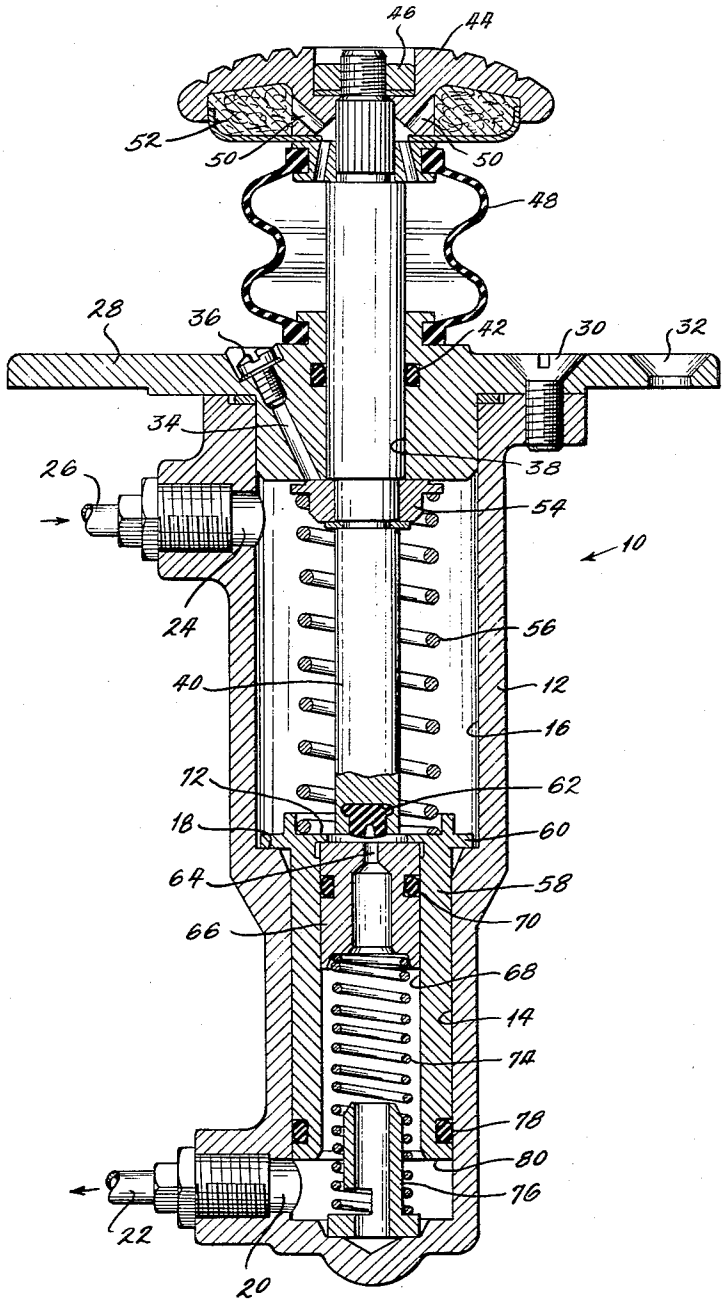
Aug. 26, 1958 S. SCHNELL 2,848,878

CONTROL CYLINDER

Filed April 27, 1956



INVENTOR:
STEVE SCHNELL

By Bravely, Leder, Woodruff & Wille
ATTORNEYS.

United States Patent Office 2,848,878 Patented Aug. 26, 1958

2,848,878

CONTROL CYLINDER

Steve Schnell, St. Louis, Mo., assignor to Wagner Electric Corporation, St. Louis, Mo., a corporation of Delaware

Original application August 9, 1952, Serial No. 303,565. Divided and this application April 27, 1956, Serial No. 581,214

6 Claims. (Cl. 60—54.6)

This invention relates generally to hydraulic power and control systems, and more particularly to a novel control cylinder or actuator for initiating a fluid pressure force.

It is an object of the present invention to provide a control cylinder for initiating or developing a fluid pressure, which provides the necessary "feel" so that the operator has an indication of the amount of pressure which is acting in opposition to the fluid pressure which has been developed. More particularly, it is an object to provide a control cylinder in which the force associated with the cylinder and resisting the further movement of the operating parts of the cylinder, is increased in response to an increase in the pressure acting in opposition to the fluid force developed by the cylinder so as to provide the necessary "feel" to the operator.

Another object is to provide a control cylinder of this type in which the pedal travel is relatively short and which will eliminate the tendency of the operator to "ride" the pedal in preference to using a long pedal stroke as required in the presently known devices.

These and other objects and advantages will become more apparent hereinafter.

Briefly, the invention comprises a control cylinder for developing fluid pressure and which includes a housing having an outlet chamber filled with fluid, first and second members mounted in the outlet chamber for relative axial movement, the first of which is movable into the chamber for developing fluid pressure and the second being movable out of the chamber responsive to the fluid pressure developed therein, means for moving the first member into the chamber, and yieldable means between the first mentioned means and the second member urging them apart.

The invention also consists in the parts hereinafter described and claimed.

The accompanying drawing which forms a part of this specification, shows a vertical sectional view of a control cylinder embodying the present invention.

This application is a division of co-pending application Serial No. 303,565, filed August 9, 1952, and entitled "Powered Hydraulic Brake Assembly," and illustrates the use of the instant device for controlling the output of a hydraulic powered fluid pressure source for a braking system.

The control cylinder 10 comprises a housing 12 containing a bore 14 in the lower end thereof, and a counterbore 16 above it and in axial alignment therewith. The upper counterbore 16 is of a slightly larger diameter than the bore 14 so as to provide a shoulder 18 therebetween. An outlet port 20 is provided at the lower end of the bore 14 for receiving a conduit 22, which may be connected to a device which is to be actuated by the control cylinder 10. Adjacent the upper end of the counterbore 16 is a fluid inlet port 24 which receives a conduit 26 which may be connected to a fluid reservoir or remote control bleeder (not shown) whereby the counterbore 16 is always filled with fluid. The upper end of the counterbore 16 is closed by a mounting plate 28 which

is secured to the housing 12 by machine screws 30. Apertures 32 are provided in the mounting plate 28 for mounting the control cylinder 10 in the proper position on the floor of an operator's control cab or the like (not shown).

A bleeder passage 34 is provided in the mounting plate 28 and is normally closed by a sealing screw 36. This provides a means for removing the entrapped air in the upper part of the counterbore 16.

The mounting plate 28 is further provided with a bore 38 which slidably receives a vertically positioned shaft 40. An O-ring 42 is positioned between the outer periphery of the shaft 40 and the wall of the bore 38 as a seal. A foot pad 44 is mounted at the upper end of the shaft 40 and is secured thereto by a fastening means 46.

A boot 48 is secured between the pad 44 and the mounting plate 28 to prevent dirt and other foreign matter from interfering with the vertical movement of the shaft 40.

Atmospheric ports 50 are provided in the foot pad 44 with a filter 52 at the ends of the ports 50 to maintain atmospheric pressure within the boot 48 and, at the same time, to prevent the entrance of foreign material which is normally excluded by the boot.

The upward movement of the shaft 40 relative to the housing 12 is limited by a stop member 54 mounted on the shaft 40 and adapted to abut the lower surface of the mounting plate 28. A spring 56 is disposed about the shaft 40 and biases it upwardly, the lower end of the spring 56 being supported on the upper end of a sleeve 58 which is slidably mounted in the bore 14 of the housing 12. The sleeve 58 can move upwardly but, contains a flange 60 at its upper end which rests on the shoulder 18 so as to limit the downward movement of the sleeve 58 relative to the housing 12.

The lower end of the shaft 40 contains a valve element 62 which controls the opening of a port 64 provided in a piston 66. The piston 66 is slidably mounted in a bore 68 which is contained in the sleeve 58 and is provided with an O-ring seal 70 to prevent the passage of pressure fluid between the outer periphery of the piston 66 and the wall of the bore 68.

The upward movement of the piston 66 relative to the sleeve 58 is limited by an inwardly extending flange 72 provided on the sleeve 58. A spring 74 is disposed in the bore 68 and normally biases the piston 66 against the flange 72. The lower end of the spring 74 is supported by a spring guide 76 which bears against the bottom wall of the bore 14.

The sleeve 58 carries an O-ring seal 78 at its lower end to prevent the passage of pressure fluid between the outer wall of the cylindrical sleeve 58 and the wall of the bore 14.

As previously described, the upper counter-bore 16 is in communication with a fluid source through the conduit 26 and the inlet port 24 so that it is always filled with fluid. When the shaft 40 is in its upper position with the valve element 62 spaced from the port 64, the fluid can flow downwardly from the upper counterbore 16, through the port 64, into the bores 68 and 14 of the sleeve 58 and housing 12, respectively, and thence outwardly through the outlet port 20 and the conduit 22. Thus, under static pressure conditions, fluid fills the interior of the control cylinder 10, and the conduit 22 between the cylinder 10 and the external device.

When the operator steps on the foot pad 44, the shaft 40 is moved downwardly against the action of the spring 56 until the valve element 62 seats against the upper end of the piston 66 and seals off the port 64. Thereafter, continued downward movement of the shaft 40 forces the piston 66 downwardly against the action of the spring 74 and exerts a pressure on the fluid in the

conduit 22 so as to cause it to move through the conduit 22 toward the external device.

If the displacement of the fluid within the conduit 22 is limited (which is the usual case), continued downward movement of the shaft 40 and the piston 66 causes the sleeve 58 to be moved upwardly due to the increased fluid pressure applied against the lower end 80 thereof. As previously mentioned, downward movement of the shaft 40 and the piston 66 is resisted by the springs 56 and 74. In addition, upward movement of the sleeve 58 relative to the housing 12, further compresses the spring 56 so that there is a double compression of it. Thus, the amount of force necessary to depress the foot pad 44 increases progressively and in stages so that the operator has the necessary "feel" during the braking action or like pressure built-up in the conduit 22.

If the pressure in the conduit 22 is increased due to the back pressure in the external device, the sleeve 58 is moved upwardly into the counterbore 16. The spring 56 is thereby further compressed by the upward movement of the sleeve 58 and the compression of the spring 56 exerts an upward force on the shaft 40 so that a slight additional effort must be exerted by the operator to maintain the parts of the control cylinder 10 in equilibrium. In fact, downward movement of the shaft 40 and piston 66 in the control cylinder 10 may be required to increase the pressure in the conduit 22 to counteract the pressure developed in the external device.

Because additional fluid cannot be displaced from the control cylinder 10 when the outlet from the conduit 22 is closed, the sleeve 58 is caused to move upwardly as the piston 66 continues to move downwardly. Thus, the upward movement of the sleeve 58 provides the additional space for the fluid being displaced by the piston 66. Of course, the downward movement of the shaft 40 requires an increasing amount of manual force because the upward movement of the sleeve 58 causes a double compression of the spring 56. This double compression of the spring 56 provides the necessary pedal "feel" for the operator.

Because a relatively small movement of the shaft 40 of the control cylinder 10 results in the actuation of the external device, there is no need or desire for the operator to "ride" the pedal 44, as is usually the case when known types of control cylinders are used which require a long pedal stroke to effect operation of the system.

It is to be understood that the present control cylinder 10 may be employed in any type of system wherein a fluid pressure is used to initiate the operation of the system, and a force acting in opposition to the output pressure of the control cylinder 10 is developed.

It is to be understood that the foregoing description and accompanying drawing have been given only by way of illustration and example, and that changes and modifications in the present disclosure, which will be readily apparent to one skilled in the art, are contemplated as within the scope of the present invention which is limited only by the claims which follow.

What I claim is:

1. A control cylinder comprising a housing having communicating inlet and outlet chambers, an outlet from said outlet chamber remote from said inlet chamber, a tubular member slidably mounted in said outlet chamber and movable into said inlet chamber, a piston having a port therethrough slidably mounted within said tubular member, a shaft mounted in said inlet chamber and carrying a valve member on one of its ends spaced from and in alignment with the port through said piston, said shaft being manually movable into port sealing and piston moving position, and yieldable means between said shaft and tubular member biasing said shaft away from said piston and said tubular member away from said inlet chamber.

2. A fluid pressure generating device comprising a housing containing a first chamber; a second chamber in the housing formed as an extension of the first chamber; an outlet from the second chamber adjacent the end of the second chamber away from the first chamber; a sleeve slidably mounted within the second chamber and movable into the first chamber; stop means limiting the movement of the sleeve away from the first chamber; a piston having an axial port therethrough slidably mounted within the sleeve; fixed means limiting the movement of the piston relative to the sleeve toward the first chamber; yieldable means restraining movement of the piston away from the first chamber; a shaft reciprocally mounted in the first chamber in axial alignment with the port in the piston and having one end thereof extending outside the housing; yieldable means between the shaft and the sleeve urging them apart; and a valve member at the other end of the shaft for engaging the piston to close off the port and move the piston away from the first chamber.

3. A control cylinder comprising a housing containing a first chamber; a second chamber in the housing formed as an extension of the first chamber; an outlet from the second chamber adjacent the end of the second chamber away from the first chamber; a sleeve slidably mounted within the second chamber and movable into the first chamber; stop means limiting the movement of the sleeve away from the first chamber; a piston having an axial port therethrough slidably mounted within the sleeve; fixed means limiting the movement of the piston relative to the sleeve toward the first chamber; yieldable means restraining movement of the piston away from the first chamber; a shaft reciprocally mounted in the first chamber in axial alignment with the port in the piston and having one end thereof extending outside the housing; a collar fixedly mounted on the shaft; a coiled spring disposed about the shaft between said collar and the end of the sleeve urging them apart; and a valve member at the other end of the shaft for engaging the piston to close off the port and move the piston away from the first chamber.

4. A control cylinder comprising a housing containing an upper first chamber; a fluid inlet into said chamber; a second chamber in the housing below the first chamber and formed as an extension thereof; a fluid outlet from the second chamber adjacent the lower end thereof; a sleeve slidably mounted in the second chamber and movable upwardly into the first chamber; stop means limiting the downward movement of the sleeve away from the first chamber; a piston having an axial port therethrough slidably mounted within the sleeve; stop means limiting the upward movement of the piston relative to the sleeve; yieldable means restraining downward movement of the piston toward the lower end of the second chamber and the outlet contained therein; a shaft reciprocally mounted in the first chamber in axial alignment with the port in the piston and having the upper end thereof extending outside the housing; a valve member at the lower end of the shaft for engaging the piston to close off the port and move the piston away from the first chamber when the shaft is moved downwardly; means limiting the upward movement of the shaft relative to the housing positioned so that the valve member is spaced from the piston when the shaft is in its uppermost position; and yieldable means between the shaft and the upper end of the sleeve urging them apart.

5. A fluid pressure generating device comprising a housing having a bore and counterbore in axial alignment forming outlet and inlet chambers, respectively, said counterbore having a relatively larger diameter than said bore to provide an annular abutment therebetween; an outlet from said outlet chamber formed adjacent to the end of said bore remote from said annular abutment; a sleeve slidably positioned in said bore and movable into said counterbore, said sleeve having first flange means adapted to contact said annular abutment to limit the movement of said sleeve into said bore; a piston slidably positioned in said sleeve and movable into said bore, yieldable means biasing said piston toward said counterbore, and second

flange means on said sleeve adapted to limit the movement of said piston toward said counterbore, said piston having a port therethrough for providing communication between said inlet and outlet chambers of said counterbore and bore, respectively; piston moving means in said counterbore including a valve element in alignment with the port in said piston, said piston moving means being manually movable in said counterbore into port sealing and piston moving position whereby said piston is moved into said bore against the restraining action of said yieldable means to develop a pressure in said outlet, said sleeve being movable into said counterbore responsive to a pressure of a predetermined magnitude being developed in said outlet, and other yieldable means between said piston moving means and said sleeve whereby movement of said sleeve into said counterbore transmits a force on said piston moving means in opposition to the manual force applied thereto.

6. A fluid pressure generating device comprising a housing containing a first chamber and a second chamber contiguous therewith, an outlet from said second chamber spaced from the first chamber, piston means movable into the second chamber to increase the fluid pressure therein, pressure-reducing means movable solely opposite to and independently of the piston means from the second chamber responsive to an increase in fluid pressure therein to reduce the pressure in said second chamber solely by displacement of the fluid within the second chamber, and yieldable means between said piston and pressure reducing means retarding the movement of the latter from the second chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

2,185,264	Mistral	Jan. 2, 1940
2,295,487	Loweke	Sept. 8, 1942
2,299,979	Hammond	Oct. 27, 1942
2,317,473	Miller	Apr. 27, 1943
2,415,245	Hopmans	Feb. 4, 1947